[0062] As is clear from the results of de-zinc-ification corrosion tests shown in Table 18 to Table 25 and Table 28 to Table 33, the first to fourth invention alloys and the eighth to twelfth invention alloys are excellent in corrosion resistance in comparison with the conventional alloys Nos. 13001 to 13003 which contain large amounts of lead. And it was confirmed that especially the fifth and sixth invention alloys which whose improvement in both machinability and corrosion resistance has been intended are very high in corrosion resistance in comparison with the conventional alloy No. 13006, a naval brass which is the most resistant to corrosion of all the expanded alloys under the JIS designations.

[0063] In the stress corrosion cracking tests in accordance with the test method described in "JIS H 3250," a 150-mm-long test piece was cut out from each extruded material. The test piece was bent with the center placed on an arc-shaped tester with a radius of 40 mm in such a way that one end forms an angle of 45 degrees with respect to the other end. The test piece thus subjected to a tensile residual stress was degreased and dried, and then placed in an ammonia environment in the desiccator with a 12.5% aqueous ammonia (ammonia diluted in the equivalent of pure water). To be exact, the test piece was held some 80 mm above the surface of aqueous ammonia in the desiccator. After the test piece was left standing in the ammonia environment for 2 hours, 8 hours, and 24 hours, the test piece was taken out from the desiccator, washed in sulfuric acid solution 10% and examined for cracks under 10X magnifications. The results are given in Table 18 to Table 25 and Table 28 to Table 33. In those tables, the alloys which developed clear cracks when held in the ammonia environment for two hours are marked "xx." The test pieces which had no cracks at 2 hours but were found clearly cracked in 8 hours are indicated by "x." The test pieces which had no cracks at 8 hours, but were found to clearly have cracks in 24 hours are

identified by the symbol "Δ". The test pieces which were found to have no cracks at all in 24 hours are indicated by the symbol "o."

[0064] As is indicated by the results of the stress corrosion cracking test given in Table 18 to Table 25 and Table 28 to Table 33, it was confirmed that not only the fifth and sixth invention alloys whose improvement in both machinability and corrosion resistance has been intended but also the first to fourth invention alloys and the eighth to twelfth alloys in which nothing particular was done to improve corrosion resistance were both equal to the conventional alloy No. 13005, an aluminum bronze containing no zinc, in stress corrosion cracking resistance. Those invention alloys were superior in stress corrosion cracking resistance to the conventional naval brass alloy No. 13006, the best in corrosion resistance of all the expanded copper alloys under the JIS designations.

[0065] In addition, oxidation tests were carried out to study the high-temperature oxidation resistance of the eighth to eleventh invention alloys in comparison with conventional alloys.

[0066] Test pieces in the shape of a round bar with the surface cut to a outside diameter of 14 mm and the length cur to 30 mm were prepared from each of the following extruded materials: No. 8001 to No. 8008, No. 9001 to No. 9006, No. 10001 to No. 10008, No. 11001 to No. 11011, and No. 13001 to No. 13006. Each test piece was then weighed to measure the weight before oxidation. After that, the test piece was placed in a porcelain crucible and held in an electric furnace maintained at 500°C. At the passage of 100 hours, the test piece was taken out of the electric furnace and was weighed to measure the weight after oxidation. From the measurements before and after oxidation was calculated the increase in weight by oxidation. It is understood that the increase by oxidation is the amount, in milligrams (mg), of increase in weight by oxidation per 10

cm^2 of the surface area of the test piece, and is calculated by the equation: increase in weight by oxidation, mg/10 cm^2 = (weight, mg, after oxidation – weight, mg, before oxidation) x (10 cm^2 / surface area, cm^2, of test piece). The weight of each test piece increased after oxidation. The increase was brought about by high-temperature oxidation. Subjected to a high temperature, oxygen combines with copper, zinc, and silicon to form Cu_2O, ZnO, SiO_2, respectively. That is, oxygen adds to the weight. It can be said, therefore, that the alloys with a smaller weight increase due to oxidation are better in high-temperature oxidation resistance. The results obtained are shown in Table 28 to Table 31 and Table 33.

[0067] As is evident from the test results shown in Table 28 to Table 31 and Table 33, the eighth to eleventh invention alloys are equal, in regard to weight increase by oxidation, to the conventional alloy No. 13005, an aluminum bronze ranking high in resistance to high-temperature oxidation among the expanded copper alloys under the JIS designations, and are far smaller than any other conventional copper alloy. Thus, it was confirmed that the eighth to eleventh invention alloys are very excellent in machinability as well as resistance to high-temperature oxidation.

Example 2

[0068] As the second series of examples of the present invention, circular cylindrical ingots with compositions given in Tables 10 and 11, each 100 mm in outside diameter and 200 mm in length, were hot extruded into a round bar 35 mm in outside diameter at 700°C to produce seventh invention alloys Nos. 70018 to 7029a. In parallel, circular cylindrical ingots with compositions given in Table 17, each 100 mm in outside diameter and 200 mm in length, were hot extruded into a round bar 35 mm in outside diameter at 700°C to produce the following alloy test pieces: Nos. 13001a to 13006a as second comparative prior art examples (hereinafter referred to as the "conventional alloys). It is noted